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ABSTRACT

In the early days of industrialisation, economists believed that the ramifications of economic growth will far outweigh the potential damage to the environment. Today the concern is the rising magnitude of emissions. Many economies are under immense pressure to reduce carbon dioxide emissions. Carbon taxation and absorption technologies seem to be the main mechanisms controlling emissions in different nations. China proposed her target of reducing carbon dioxide emissions by 40-45% by 2025. The purpose of this study is to determine if China's ambition of reducing its carbon dioxide emissions is feasible. This investigation also examines the potential effects of China's emissions on the economic growth of other countries. The study demonstrates that China's target may not only reduce her output, but may also adversely affect the economic growth of others. This article further reveals that unemployment in China is likely to soar during the reduction in emissions and energy consumption. Additionally, this paper evaluates the effects of green taxation on carbon dioxide emissions. In conclusion, there is a possibility that China may reach her emissions target by 2025. However, the country faces a dilemma between economic growth and environmental preservation. It is recommended that China should explore techniques which will reduce emissions but not impinge negatively on economic growth.

KEYWORDS: carbon dioxide emissions; economic growth; green taxation; energy consumption

1. Introduction

Every country's aim is high economic growth. This is because economic growth is associated with positive effects such as low unemployment rate, reduced crime rate, high life expectancy and overall prosperity of the drivers of the economy. The hitch is that economic growth is not entirely without its expense. In Economics, such drawbacks are referred to as opportunity costs. For decades, economists assumed that in the long run the opportunity costs of economic growth will not outweigh the gains of economic prosperity. However, today as the global economy progresses exponentially, the opportunity costs of economic growth are more apparent. Carbon dioxide emissions from manufacturing industries are a major concern affecting the world. There are other environmental problems such as the pollution of water sources, over-consumption of fossil fuels, land degradation by the mining sector and the disruption of aquatic life. Globally, policy makers tend to put emphasis on the need to reduce carbon dioxide discharges. The concern is that environmental preservation is no longer a priority. However, it is important to note that any effort attempting to redeem the environment, such as forest plantations, is still a necessity.

Many countries are focused on reducing carbon dioxide emissions in order to minimize global warming. Carbon dioxide emissions cannot be eliminated completely because industries need energy to operate and manufacture products. This energy usage eventually produces carbon dioxide as the product of combustion. China is one country which is under immense pressure to reduce its carbon emissions. China's economic growth has been impressive but it is the largest emitter of carbon dioxide globally. Consequently, there is friction between economic growth and environmental preservation. India also registered the highest growth in carbon emissions recently. Every country's efforts at reducing carbon dioxide emissions are critical. China reacted to the insurmountable pressure to reduce carbon emissions by proposing a 40-45% reduction in its carbon dioxide emissions by 2025. There are several repercussions attached to this aim. Firstly, China is one of the largest exporters in the world, therefore, policy makers are interested in how this alteration will affect industrial output and international trade. In addition, economic growth is dependent on energy consumption. The question is, if the aim is to reduce carbon emissions what are the implications for energy consumption in China? How will this eventually affect China's aim to be the largest economy in the world?

This analysis attempts to answer these questions and determines if it is possible for China to reach her emissions target. Overall, reducing carbon dioxide emissions is likely to bring positive impacts. For instance, if carbon dioxide emissions are reduced, the expectation is that fossil fuels will be consumed cautiously. Eventually, the production of other gases such as sulphur dioxide will also be minimised. Carbon dioxide is not only emitted from the diverse

exporting sectors of a particular economy. Automobiles also exacerbate the problem through their internal combustion of gasoline. Most European economies such as Germany are well established car manufacturers. The challenge is that these vehicles are also operated by fossil fuels. As a result, economies will have to shift to solar powered vehicles or hydrogen powered automobiles.

This article is structured as follows. Next will be a discussion of the diverse relationships between economic growth, carbon dioxide emissions and energy consumption. Subsequently, a discussion of current measures on carbon dioxide reduction follows. This will be followed by implications of the study and whether China should opt for economic growth or environmental preservation. Finally a conclusion of the study follows.

2. The dynamics of energy consumption, carbon dioxide emissions and economic growth

Empirical evidence has demonstrated that there are long running relationships between energy consumption, carbon dioxide emissions and economic growth. Alshehry and Belloumi (2015) investigated the dynamic relationship between energy usage, prices and economic growth in Saudi Arabia using a demand-side approach. The results indicated that there exists a long running relationship between these three variables. The study further demonstrated that in the short term, there is a unidirectional causality running from carbon emissions to energy consumption. The most important question policy makers need to address is: *does reducing energy consumption diminish economic growth?* In the Alshehry and Belloumi (2015) empirical study, it was found that in Saudi Arabia, policies aimed at reducing carbon dioxide may not disrupt economic growth. The anticipation is that as the consumption of energy plunges, carbon dioxide emissions will decline. Even though empirical evidence may suggest that the economy will not be affected significantly in this transaction, the problem is that most economies still rely on fossil fuels for energy. Fossil fuels produce insurmountable discharges of carbon dioxide emissions during combustion. For this reason, economic growth policies should also address the use of alternative energy sources such as tidal, wind, geothermal and solar energies. The energy values provided by these sources are significantly lower than the value from fossil fuels but environmental damage is much lower under each scenario.

Another study by Omri (2013) examined the connections between carbon dioxide emissions, energy consumption and economic growth using simultaneous equation models for fourteen countries over the period 1990 and 2011. The study showed that there exists a bidirectional causal relationship between energy consumption and economic growth. The results further supported the occurrence of unidirectional causality from energy consumption to carbon

dioxide emissions. The results of this study are conceivable because if there is a causal relationship between energy consumption and economic growth, it denotes a long term relationship. In addition, Omri (2013) concluded that there exist bidirectional causal relationships between economic growth and carbon dioxide emissions. The bidirectional causal relationship between economic growth and carbon dioxide emissions could mean that industrial output drives carbon dioxide emissions. The study may also suggest that carbon emissions from industrial production lead national income.

Zhang and Cheng (2009) contributed to the research by investigating the existence and direction of causation between economic growth, energy consumption and carbon emissions in China using a multivariate model. Evidence showed that both carbon dioxide emissions and energy consumption do not lead economic growth in China. Consequently, Zhang and Cheng (2009) argued that the government of China can pursue a conservative energy policy without necessarily impinging on economic growth. The results of this study were good news for China because the country intends to cut down emissions to a reasonable extent without hampering economic growth. This does not mean that emissions should not be monitored. Even so, empirical models do not necessarily reflect the current state of affairs. Though there is no causality between carbon dioxide emissions, energy consumption and economic growth, China is still the largest emitter of carbon dioxide and as a result, the largest contributor to the greenhouse effect.

Soytas and Sari (2009) investigated the long-run causality effect between economic growth, carbon dioxide emissions and energy consumption in Turkey. Empirical evidence revealed that carbon emissions seem to Granger cause energy consumption. By implication, Soytas and Sari (2009) argued that in order to reduce emissions, Turkey is not inclined to relinquish economic growth. The results of this study are similar to the results of Zhang and Cheng (2009). Zhang and Cheng (2009) highlighted that energy policies in China can be implemented without impinging on economic growth. Therefore, the two studies reject the propositions of the Environmental Kuznets Curve. The theory postulates that as an economy expands, carbon dioxide emissions will elevate. Jafari et al. (2012) examined the long running causality between economic growth, carbon dioxide emissions and energy consumption from 1971 to 2009 in Indonesia using the Toda-Yamamoto procedure. The study signalled that there was no relationship between the variables except causality from urban population to energy consumption. The authors highlighted that the absence of long term causal affiliations could mean that energy conservation strategies in Indonesia may not be fruitful in reducing carbon

emissions. Moreover, Indonesia does not have to forgo economic growth in her endeavours. For these reasons, the authors also rejected the propositions of the Environmental Kuznets Curve in Indonesia.

The results of these studies generally do not support the ideals of Economics theory. In practice, the relationship between carbon emissions and economic growth is dynamic. Even though the Economics theory may not hold, there is a high probability of immense emissions over time. The challenge with empirical models is that they tend to provide long term relationships between the variables. In this way, there could be massive emissions over some periods comparatively. For example, the magnitude of China's emissions five decades ago, may not be proportional to its emissions in the late 2000s. The glitch is these models do not show the troughs and peaks of emissions over the examined period. Conclusively, it is conceivable that when examining the long term relations between carbon dioxide emissions, economic growth and energy consumption empirically, the associations may disregard the fundamentals of the Environmental Kuznets Curve.

3. Implications of China's emissions reduction

Li et al. (2011) argued that China's economic growth is attributed to policy reforms and an open-door policy on trade. China's proposition of reducing carbon dioxide emissions carries implications. China is the second largest economy in the world and her income has been export-led. Many countries rely on China for their imports. The problem is, if China reduces carbon emissions to a reasonable extent, the country will, in effect, be bound to reduce energy consumption. Moreover, since exports require energy, this policy can impinge on export production and eventually on economic growth. This will work against the Chinese political objective of becoming the world's largest economy. Hypothetically, the Chinese government does not necessarily have to reduce energy consumption if they employ environmentally friendly energy sources. Schmalensee et al. (1998) postulated that the rate of future warming will depend on natural processes and on the intensity of greenhouse gas emissions. Most economies, however, refrain from using environmentally friendly energy sources like tidal, wind or solar energies because of their low energy value. Even some fossil fuel products such as natural gas have a low energy value compared to coal. Organic sources of energy with high energy values usually produce enormous carbon dioxide emissions. Many African economies which rely on Chinese exports will be negatively affected by this transaction. There is, however, one route the Chinese economy can take to cover up for the reduction in energy consumption. The principles of supply and demand can apply in this scenario. If the Chinese

economy produces fewer products and such commodities are in high demand, China as the exporter will be forced to raise the prices of these commodities. Following Achmad and Hamzani (2015) if net exports are moving in a positive direction, GDP will rise. The total effect is that the economy will still be intact. However, there are problems with this ideal.

The application of Economics in practical situations sometimes results in conflict. Raising the prices can backfire and importers can seek more reasonable prices elsewhere especially from fast growing economies such as those of India, Brazil, South Africa and Russia. The Chinese economy has been termed "export-led" where exports are the main driver of national income. If the government is keen on reducing carbon emissions, there will be a need to welcome new drivers of the economy. For instance one of Australia's main economic drivers is education. Some economies such as Botswana accrue substantial income from the tourism sector. This shift in the drivers of the economy requires a lot of transformation and clear national development goals. Currently, the focus of the Chinese economy is to reduce carbon emissions to a reasonable extent. However, policy decisions do not address the ramifications of such moves on the total labour force. Logically, some workers will be sacked as a result of reducing energy consumption. In short, unemployment rates are likely to soar in China if this issue is not addressed.

4. Current measures in place

Regulations on carbon dioxide emissions are difficult to enforce because such controls impinge negatively on economic growth. A high GDP reflects the robust growth of an economy (Divya and Devi, 2014). Most economies such as Malaysia prefer to use carbon taxation as a tool to combat carbon dioxide emissions. Loganathan et al. (2014) explored how carbon taxation and economic growth affect environmental degradation in Malaysia. The study used data from 1974 to 2010 and applied econometric models to determine long term relationships between the variables. Evidence brought forward by empirical analysis showed that there is co-integration between economic growth and carbon taxation. The results postulated that there is a long term relationship between carbon taxation and economic growth. Causality tests demonstrated bidirectional causation between carbon tax and carbon dioxide emissions. Economic growth drove carbon dioxide emissions and carbon taxation led economic growth. This study carries connotations for policies on carbon dioxide reduction. Firstly, the long term relationship between carbon taxation and economic growth means that economies such as China and Malaysia do not have to forgo economic growth in their strategies to minimize carbon dioxide emissions. It is reasonable to expect economic growth to lead carbon dioxide in terms of causality. The most important causality evidenced by the Malaysian economy is the causal link

running from carbon taxation and economic growth. Carbon taxation does not only curb carbon emissions, the revenue collected may well be used to support environmental clean-up campaigns.

Another empirical study by Zhixin and Ya (2011) supports the findings of Loganathan et al. (2014). The researchers analysed twenty-nine Chinese provinces between 1999 and 2008 using the Generalised Least Squares (GLS) estimates. The study found that the effects of carbon taxation on economic growth varied between the provinces. The authors noted that there is a high probability that carbon tax could stimulate economic growth of most eastern regions of China. However, carbon taxation did not favour economic growth in the middle and western areas of China. Consequently, Deng et al. (2015) suggested that countries should reuse carbon dioxide with absorption and desorption technologies and such carbon dioxide can be used to produce exportable commodities such as calcium carbonate. Technological advancements in the automobile industry are also necessary in the case of China. Xu and Lin (2015) observed that between 1980 and 2012 carbon dioxide emissions in China's transport sector increased approximately 9.7 times with an annual growth rate of 7.4%. In summary, the watchdog of emissions is carbon taxation. Previously Schafer and Victor (1999) argued that even though transportation is vital for the growth of modern economies, it runs parallel with vexing environmental problems. Comparatively, almost 40% of total US carbon dioxide emissions are associated with residences and automobiles following Glaeser and Kahn (2008). The authors suggest that changing patterns of urban development and transportation can reduce emissions significantly in the case of the US. This may well also apply to China.

5. Conclusions and implications

This study examined the prospects and ramifications of China's planned reduction in carbon dioxide emissions. China is currently the largest consumer of energy and the highest emitter of carbon dioxide. This investigation took the initiative of determining if the possibility of China's target could disturb its economic growth. Previous studies on the dynamic relationship between energy consumption and carbon dioxide documented a positive relationship between the variables. Subsequently, evidence showed that economic growth and carbon dioxide emissions trend positively in the long run. This study has demonstrated that it is likely that as energy consumption is reduced, economic growth in the Chinese economy will also be hindered. Numerous economies will be disadvantaged by this prospect because the Chinese economy would be obliged to reduce production of exports. Consequently, it is likely that the Chinese economy will be in a precarious position. Theoretically, the recommendation will be to raise

the price of commodities. However, this can push importers of Chinese merchandise away to rival producers like India and Brazil.

The other postulation is to change the drivers of the economy so that the economy is not wholly export-led. Nevertheless, this route will require time and an exhaustive implementation of development goals. The Chinese economy will possibly face problems of unemployment if the reduction of carbon emissions is firmly enforced. The mainstay of current measures in place to combat emissions is green taxation. A carbon levy appears to be more effective as it supports economic growth. The challenge with high taxes is that they can result in low output resulting in declining economic growth. Nonetheless, carbon dioxide absorption and desorption technologies are likely to have significant impact on the reduction of emissions. These techniques also support a variety in exports as the carbon dioxide collected can be used to produce exportable commodities such as calcium carbonate. In addition, the automobile industry needs to shift from its consumption of fossils fuels to hydrogen or solar powered vehicles.

Based on this study, whether China reaches her goal of a 40-45% reduction in carbon dioxide emissions by 2025 is a matter of whether the Chinese government will settle for economic growth or environmental preservation. The decision is complicated by the fact that the world is a global village. Environmental damage in one place can be infectious. In addition, China's target will involve multitudes if it is to be realised. Significant individuals and exporting industries such as automobile manufacturers have to be part and parcel of this dramatic change. It is conceivable that China can reach her target if the current carbon taxation is upheld. It will be imperative to introduce carbon dioxide absorption and desorption technologies to trap and process carbon dioxide as an exportable commodity. The proposed use of carbon dioxide monitoring satellites by China will be of great assistance in this endeavour given the dismissal of the emissions trading system.

The Chinese economy should monitor carbon dioxide emissions regularly because environmental effects will not cease as long as excess carbon dioxide is produced. Even if the target is reached, the status of the greenhouse effect in 2025 will be unknown and it has to be accounted for. The focus for China should not only be about reducing its emissions but also what the country can do to redeem the environment. In conclusion, it is plausible that China can reach her target for reducing carbon emissions. However, there is still a need to make progress in restoring the environment. Efforts such as forest plantations are always welcome. Aiming to reduce emissions alone will not be fruitful in the long run.

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